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The social mother as biological mother

OPINIONS

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Egg donation constitutes a meeting of heredity and environment, both of which can be explained in terms of biology. There is much to suggest that the intrauterine and postnatal environment, but also the environment of upbringing, trigger epigenetic, chemical reactions that change the gene expression in the child. The social mother who carries the child in utero imparts to it a biological similarity to herself, which has a bearing on the child's mental health and intellect.

The new report to the Norwegian Parliament, the Storting, on biotechnology was published on 16 June this year (1). The ban on egg donation was retained, as part of a political strategy. In an editorial, Ragnhild Ørstavik, deputy editor-in-chief of the Journal of the Norwegian Medical Association, maintains that egg donation can be recommended (2). Recent knowledge on epigenetics and how the environment influences our gene expression has not been highlighted in the debate on egg donation. In this article, I wish to call attention to some factors that may contribute to the debate.

Monozygotic (identical) twins share the same genotype, i.e. their genetic material is identical at birth. When raised in different environments, most monozygotic twin pairs are non-identical later in life. This is expressed, for example, through differences in susceptibility to disease and a broad range of anthropomorphic characteristics (3). However, for more than 50 years we have known that we are neither 'born that way nor become that way, but we are born to become that way.' But how?

Genes are permanent building blocks. Changes can only occur as a result of a random mutation, i.e. a successful error in transferring the genes themselves to the next generation. Occasionally an error occurs during replication of the DNA molecule. Without these genetic errors, there would have been no development from the first cell to the first human – four billion years of history. There is strong scientific evidence for this. Evolution is therefore not something you believe in, it is something you understand.

Epigenetics refers to non-permanent changes triggered by the environment – successfully or otherwise – through methylation and acetylation of histone proteins on different regions of DNA (4). These chemical reactions result in changes in the chemical charge between the histone tail and DNA, which causes the DNA to clump together or open. This means that the library of inactive genes is activated and active genes are inactivated. The gene expression is altered. The epigenetic effect on the genes may be transitory, but can also be transferred to the next generation and may be permanent through the course of several generations (4–6).

We are not puppets at the mercy of our genes

This 'epigenetic inheritance' may have a key bearing on the child's mental health (4, 7) and intellect (8–10). Although monozygotic twins are epigenetically identical in their early years, it is possible later in life to determine locus-specific variations in DNA methylation and histone acetylation as an expression of epigenetic differences. The influence of upbringing and environment therefore manifests itself in the gene expression (3).

Which environment are we referring to? The uterus carrying the fertilised egg is now defined as a highly sensitive environment, of crucial importance for development of disease in the child in later life (6), (11–14). The intrauterine environment is also dependent on the state of mind (6, 11) and lifestyle (4, 7) of the pregnant mother.

Characteristics such as cognitive function, i.e. the capacity to learn, understand, solve problems and think critically, are influenced by the woman who bears and rears the child. It is estimated that 40 – 60 % of these cognitive functions are genetically inherited (8), i.e. from the biological mother who donated the egg. The remaining 40 – 60 % will be dependent on stimuli from the mother who carries the child in utero, and breastfeeds and cares for the child after the birth, especially in the neonatal period (4).

The environment will also have a more decisive bearing than the egg donor on the child's mental health. Mental illness is strongly related to the environment to which the child is exposed, for example by its parents (7). It is therefore irrational to think that we are 'puppets' at the mercy of our genes. The pregnant mother will have a significant influence on the child's characteristics and development.

Epigenetics has provided a biological basis for mental health that unites body and soul to provide an integrated understanding of human health and behaviour, writes Linn Getz in the Journal of the Norwegian Medical Association (15). This knowledge is therefore essential for the development of the child's personality and intellect.

When an egg is donated, this means that the social mother, who has nurtured the fertilised egg until the birth and has breastfed and raised the child, has imparted to the child a biological similarity to herself. In part, she has in fact become a biological mother. Just as in the case of monozygotic twins, this initial phase is also important for the later development of phenotypic characteristics (3).

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